

WHAT IS CLAIMED IS:

1. A semiconductor device comprising:

a seal member formed of an insulating resin;

a tab whose back side is exposed to a mounting surface of the seal member, the tab having, on a surface thereof opposite to the back side, a semiconductor element fixing area and wire connection areas;

tab suspension leads exposed to the mounting surface of the seal member and contiguous to the tab;

a plurality of leads whose back sides are exposed to the mounting surface of the seal member;

a semiconductor element positioned within the seal member and fixed through an adhesive onto the semiconductor element fixing area on the surface of the tab in such a manner that a back side thereof is opposed to the tab surface;

a plurality of electrodes formed on a main surface of the semiconductor element;

electrically conductive wires for electrically connecting the plural electrodes and surfaces of the leads with each other; and

electrically conductive wires for electrically connecting the electrodes on the semiconductor element and the wire connection areas on the tab with each other;

wherein the tab is formed larger than the



semiconductor element so that outer peripheral edges of the tab are positioned outside outer peripheral edges of the semiconductor element; and

wherein a groove is formed in the surface of the tab so as to be positioned between the semiconductor element fixing area and the wire connection areas.

2. A semiconductor device according to claim 1, wherein the groove surrounds a whole circumference of the semiconductor element fixing area.

3. A semiconductor device according to claim 1, wherein the adhesive is not applied to the wire connection areas on the tab.

4. A semiconductor device according to claim 1, wherein a plating film is formed selectively on the wire connection areas of the tab and the surfaces of the leads, and the wires are connected onto the plating film.

5. A semiconductor device according to claim 1, wherein an area of the surface of the tab is larger than that of the back side of the tab.

6. A semiconductor device according to claim 5, wherein the tab has a section which is in the shape of an inverted trapezoid.

7. A semiconductor device according to claim 1, wherein the adhesive is applied also to the interior of the groove and the semiconductor element is larger than the



semiconductor element fixing area and is fixed also onto the groove through the adhesive.

8. A semiconductor device according to claim 1, wherein the groove is selectively formed correspondingly to areas where the wires are connected.

9. A semiconductor device according to claim 1, wherein the tab is quadrangular and the groove is formed selectively in a mutually independent manner without being formed at four corners of the tab.

10. A semiconductor device according to claim 1, wherein the tab is quadrangular and the groove is formed selectively in a mutually independent manner along sides of the quadrangle.

11. A semiconductor device according to claim 1, wherein grooves are formed in the surfaces of the leads respectively and the wires are connected at positions closer to the semiconductor element with respect to the grooves formed in the surfaces of the leads.

12. A semiconductor device according to claim 1, wherein the grooves are formed by pressing work.

13. A semiconductor device comprising:

- a seal member formed of an insulating member;

- a tab whose back side is exposed to a mounting surface of the seal member, the tab having, on a surface thereof opposite to the back side, a semiconductor element fixing



area and wire connection areas;

tab suspension leads exposed to the mounting surface of the seal member and contiguous to the tab;

a plurality of leads whose back sides are exposed to the mounting surface of the seal member;

a semiconductor element positioned within the seal member and fixed through an adhesive onto the semiconductor element fixing area on the surface of the tab in such a manner that a back side thereof is opposed to the tab surface;

a plurality of electrodes formed on a main surface of the semiconductor element;

electrically conductive wires for electrically connecting the plural electrodes and surfaces of the leads with each other; and

electrically conductive wires for electrically connecting the electrodes on the semiconductor element and the wire connection areas on the tab with each other,

wherein the tab is formed larger than the semiconductor element; and

wherein a plating film is formed selectively on the wire connection areas and the surfaces of the leads and the wires are connected onto the plating film.

14. A semiconductor device comprising:

a seal member formed of an insulating resin;



a tab whose back side is exposed to a mounting surface of the seal member, the tab having, on a surface thereof opposite to the back side, a semiconductor element fixing area and wire connection areas;

tab suspension leads exposed to the mounting surface of the seal member and contiguous to the tab;

a plurality of leads whose back sides are exposed to the mounting surface of the seal member;

a semiconductor element positioned within the seal member and fixed through an adhesive onto the semiconductor element fixing area on the surface of the tab in such a manner that a back side thereof is opposed to the tab surface;

a plurality of electrodes formed on a main surface of the semiconductor element;

electrically conductive wires for electrically connecting the plural electrodes and surfaces of the leads with each other; and

electrically conductive wires for electrically connecting the electrodes on the semiconductor element and the wire connection areas on the tab with each other,

wherein the tab is formed larger than the semiconductor element; and

wherein grooves are formed in the surfaces of the leads respectively and the wires are connected at positions



closer to the semiconductor element with respect to the grooves formed in the surfaces of the leads.

15. A semiconductor device comprising:

- a semiconductor element;

- a tab with the semiconductor element fixed to a surface thereof;

- a plurality of leads formed in a mutually independent manner so that inner ends thereof are positioned close to peripheral edges of the tab;

- wires for electrically connecting electrodes on the semiconductor element and the inner ends of the leads with each other;

- wires for electrically connecting the electrodes on the semiconductor element and the tab with each other; and

- a seal member formed of an insulating resin, the seal member being formed so as to cover the semiconductor element, the tab, the wires and the inner end sides of the leads,

- wherein the tab is formed larger than the semiconductor element so that outer peripheral edges thereof are positioned outside outer peripheral edges of the semiconductor element;

- wherein a groove is formed in the surface of the tab so as to be positioned between a semiconductor element fixing area to which the semiconductor element is fixed and



wire connection areas to which the wires are connected; and

wherein a plating film is formed selectively on wire-connecting surfaces areas of the tab and the leads and the wires are connected onto the plating film.

16. A semiconductor device according to claim 15, wherein the groove surrounds a whole circumference of the semiconductor element fixing area.

17. A semiconductor device according to claim 15, wherein the adhesive is not present outside the groove.

18. A semiconductor device according to claim 15, wherein an area of the tab surface to which the semiconductor element is fixed is larger than that of a back side of the tab.

19. A semiconductor device according to claim 15, wherein the tab has a section which is in the shape of an inverted trapezoid.

20. A semiconductor device according to claim 1 or claim 19, wherein the semiconductor element fixing area is smaller than the semiconductor element.

21. A semiconductor device according to claim 15, wherein the groove is selectively formed correspondingly to areas to which the wires are connected.

22. A semiconductor device according to claim 15, wherein the tab is quadrangular and the groove is selectively formed in a mutually independent manner without being



formed at four corners of the tab.

23. A semiconductor device according to claim 15, wherein the tab is quadrangular and the groove is selectively formed in a mutually independent manner along sides of the quadrangle.

24. A semiconductor device according to claim 15, wherein grooves are formed in the leads respectively and the wires are connected to front end sides of the leads located outside the grooves.

25. A semiconductor device according to claim 15, wherein the groove is formed by pressing work.

26. A semiconductor device comprising:

- a seal member formed of an insulating resin;

- a tab whose back side is exposed to a mounting surface of the seal member, the tab having, on a surface thereof opposite to the back side, a semiconductor element fixing area and wire connection areas;

- tab suspension leads exposed to the mounting surface of the seal member and contiguous to the tab;

- a plurality of leads whose back sides are exposed to the mounting surface of the seal member;

- a semiconductor element positioned within the seal member and fixed through an adhesive onto the semiconductor element fixing area on the surface of the tab in such a manner that a back side thereof is opposed to the tab



surface;

a plurality of electrodes formed on a main surface of the semiconductor element;

electrically conductive wires for electrically connecting the plural electrodes and surfaces of the leads with each other; and

electrically conductive wires for electrically connecting the electrodes on the semiconductor element and the wire connection areas on the tab with each other,

wherein the tab is formed larger than the semiconductor element so that outer peripheral edges of the tab are positioned outside outer peripheral edges of the semiconductor element;

wherein a recess larger than the semiconductor element is formed in the surface of the tab;

wherein the semiconductor element fixing area is positioned within the recess; and

wherein the semiconductor element is fixed to a bottom of the recess through an adhesive.

27. A semiconductor device according to claim 26, wherein a plating film is selectively formed on surfaces of the wire connection areas of the tab and surfaces of the leads and the wires are connected onto the plating film.

28. A semiconductor device according to claim 26, wherein an area of the tab surface on the semiconductor element-



fixed side is larger than that of the back side of the tab.

29. A semiconductor device according to claim 28, wherein the tab has a section which is in the shape of an inverted trapezoid.

30. A semiconductor device according to claim 26, wherein grooves are formed in the surfaces of the leads respectively and the wires are connected at positions closer to the semiconductor element with respect to the grooves formed in the surfaces of the leads.

31. A semiconductor device according to any of claims 1, 13, 14, and 26, wherein the tab, the tab suspension leads, and the plural leads are each formed of a metal.

32. A semiconductor device according to any of claims 1, 13, 14, and 26, wherein the tab, the tab suspension leads, and the plural leads are all formed of one and same metallic material.

33. A semiconductor device according to any of claims 1, 13, 14, and 26, wherein the plural leads are arranged around the tab and a space between the leads and the tab is filled with the seal member.

34. A semiconductor device according to claim 1, wherein the wire connection areas on the tab are electrically connected through a plurality of wires to a plurality of electrodes as voltage supply electrodes for the semiconductor element.



35. A semiconductor device according to claim 1, wherein the groove is formed so as to surround a whole circumference of the wire connection areas.

36. A method of manufacturing a semiconductor device, comprising the steps of:

- (a) providing a lead frame, the lead frame comprising a plurality of lead portions, a tab having a semiconductor element fixing area and wire connection areas, a plurality of tab suspension leads contiguous to the tab, a groove portion formed between the semiconductor element fixing area and the wire connection areas, and a frame portion which connects the plural lead portions and the plural tab suspension leads with each other;
- (b) mounting a semiconductor element onto the semiconductor element fixing area through an adhesive;
- (c) electrically connecting through bonding wires between the semiconductor element and the plural lead portions and also between the semiconductor element and the wire connection areas;
- (d) forming a resin seal member which seals the semiconductor element and the bonding wires and which partially covers the tab, the plural tab suspension leads and the plural lead portions so that back sides of the tab, the plural tab suspension leads and the plural lead portions are exposed to a mounting surface side of the



resin seal member; and

(e) separating the plural lead portions and the plural tab suspension leads from the frame portion.

37. A method of manufacturing a semiconductor device according to claim 36, further including the steps of:

(f) providing a wiring board, the wiring board having electrodes at positions opposed respectively to the tab and the plural lead portions which are exposed to the mounting surface side of the resin seal member;

(g) causing the electrodes on the wiring board to be opposed to the tab and the plural lead portions through solder paste; and

(h) melting the solder paste by a heat treatment to connect the tab and the plural lead portions electrically with the electrodes on the wiring board.

38. A method of manufacturing a semiconductor device according to claim 37, wherein the electrodes on the wiring board opposed to the tab are voltage supply electrodes.

39. A method of manufacturing a semiconductor device according to claim 36, wherein the wire connection areas and the plural lead portions in the lead frame provided in step (a) are plated at least partially.

40. A semiconductor device comprising:

a seal member formed of an insulating resin;

a tab whose back side is exposed to a mounting surface.



of the seal member, the tab having, on a surface thereof opposite to the back side, a semiconductor element fixing area and wire connection areas;

tab suspension leads exposed to the mounting surface of the seal member and contiguous to the tab;

a plurality of leads whose back sides are exposed to the mounting surface of the seal member;

a semiconductor element positioned within the seal member and fixed through an adhesive onto the semiconductor element fixing area on the surface of the tab in such a manner that a back side thereof is opposed to the tab surface;

a plurality of electrodes formed on a main surface of the semiconductor element;

electrically conductive wires for electrically connecting the plural electrodes and surfaces of the leads with each other; and

electrically conductive wires for electrically connecting the electrodes on the semiconductor element and the wire connection areas on the tab with each other,

wherein the tab is formed larger than the semiconductor element so that outer peripheral edges of the tab are positioned outside outer peripheral edges of the semiconductor element; and

wherein a slit which pierces the tab is formed



partially in the tab portion positioned between the semiconductor element fixing area and the wire connection areas.

41. A semiconductor device according to claim 40, wherein the semiconductor element fixing area is quadrangular and the slit formed as a single slit or as a row of plural intermittent slits along sides of the semiconductor element fixing area.

42. A semiconductor device according to claim 41, wherein from the slit toward an outer peripheral edge of the tab there is formed one or plural slits so as not to reach an edge of the tab.

43. A semiconductor device according to claim 42, wherein the wire connection areas are partially surrounded with the slit and the one or plural slits extending from the slit.

44. A semiconductor device according to claim 41, wherein from the slit toward an outer peripheral edge of the tab there is formed one or plural grooves.

45. A semiconductor device according to claim 44, wherein the wire connection areas are partially surrounded with the slit and the one or plural grooves extending from the slit.

46. A semiconductor device according to claim 40, wherein the adhesive is not applied to the wire connection areas on the tab.

47. A semiconductor device according to claim 40, wherein



a plating film is selectively formed on surfaces of the wire connection areas of the tab and surfaces of the leads, and the wires are connected onto the plating film.

48. A semiconductor device according to claim 40, wherein an area of the surface of the tab is larger than that of the back side of the tab.

49. A semiconductor device according to claim 40, wherein the tab is quadrangular and the slit is formed selectively in a mutually independent manner without being formed at four corners of the tab.

50. A semiconductor device according to claim 40, wherein grooves are formed in the surfaces of the leads respectively and the wires are connected at positions closer to the semiconductor element with respect to the grooves formed in the surfaces of the leads.

51. A semiconductor device according to claim 40, wherein the tab, the tab suspension leads, and the plural leads are all formed of one and same metallic material.

52. A semiconductor device according to claim 40, wherein the plural leads are arranged around the tab and a space between the leads and the tab is filled with the seal member.

53. A semiconductor device according to claim 40, wherein the wire connection areas on the tab are electrically connected through a plurality of wires to a plurality of



electrodes as voltage supply electrodes for the semiconductor element.

54. A method of manufacturing a semiconductor device, comprising the steps of:

(a) providing a lead frame, the lead frame comprising a plurality of lead portions, a tab having a semiconductor element fixing area and wire connection areas, a plurality of tab suspension leads contiguous to the tab, a slit, or a slit and a groove contiguous thereto, the slit or the slit and the groove contiguous thereto being formed between the semiconductor element fixing area and the wire connection areas, and a frame portion which connects the plural lead portions and the plural tab suspension leads with each other;

(b) mounting a semiconductor element onto the semiconductor element fixing area through an adhesive;

(c) electrically connecting through bonding wires between the semiconductor element and the plural lead portions and also between the semiconductor element and the wire connection areas;

(d) forming a resin seal member which seals the semiconductor element and the bonding wires and which partially covers the tab, the plural tab suspension leads and the plural lead portions so that back sides of the tab, the plural tab suspension leads and the plural lead



portions are exposed to a mounting surface side of the resin seal member; and

(e) separating the plural lead portions and the plural tab suspension leads from the frame portion.

55. A method of manufacturing a semiconductor device according to claim 54, further including the steps of:

(f) providing a wiring board, the wiring board having electrodes at positions opposed respectively to the tab and the plural lead portions which are exposed to the mounting surface side of the resin seal member;

(g) causing the electrodes on the wiring board to be opposed to the tab and the plural lead portions through solder paste; and

(h) melting the solder paste by a heat treatment to connect the tab and the plural lead portions electrically with the electrodes on the wiring board.

56. A method of manufacturing a semiconductor device according to claim 55, wherein the electrodes on the wiring board opposed to the tab are voltage supply electrodes.

57. A method of manufacturing a semiconductor device according to claim 55, wherein the wire connection areas and the plural lead portions in the lead frame provided in step (a) are plated at least partially.